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LUIZ RICARDO L. SIMONE

Museu de Zoologia da Universidade de São Paulo, Caixa Postal 42494, 04299-970 São Paulo, SP, Brazil; e-mail: lrsimone@usp.br

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Abstract

A detailed morphological study was performed in the following species of *Crepidula*: 1) *C. margarita* new species from Venezuela; 2) *C. plana* Say, 1822; 3) *C. atrasolea* Collin, 2000; 4) *C. depressa* Say, 1822, from Florida, USA; 5) *C. pyguaia*, new species from Santa Catarina coast, Brazil; 6) *C. carioca*, new species from Rio de Janeiro coast, Brazil. Additionally, five other species anatomically studied in Simone (2002) were also included: 7) *C. argentina* Simone, Pastorino & Penchaszadeh, 2000, from Argentina; 8) *C. glauca* Say, 1822, from Venezuela; 9) *C. fornicata* (Linné, 1758), from Mediterranean and Florida; 10) *C. protea* Orbigny, from S.E. Brazil; 11) *C.* aff. *plana*, here described as *C. intratesta* new species, from S.E. Brazil; 12) *C. cachimilla* Cledón Simone & Penchaszadeh, 2004, from Patagonia. The 46 characters (106 states) for these species were phylogenetically analyzed and a single cladogram was obtained (length: 93, CI: 65; RI: 64) as follows: (*Crepidula cachimilla* (*C. argentina* ((*C. carioca C. pyguaia*) ((*C. fornicata* (*C. intratesta C. protea*)) ((*C. glauca C. margarita*) (*C. plana* (*C. atrasolea C. depressa*))))))). Two outgroups were used: *Bostrycapulus aculeatus* (Gmelin, 1791), which most authors consider a *Crepidula* (operationally analyzed as part of the ingroup), and the remaining calyptraeoideans studied by the author. The monophyly of the ingroup is confirmed, supported by 25 morphological synapomorphies. Although the ingroup is fully resolved, no clades are formally named, because the phylogeny is still considered provisional. Most studied species belong to an informal group called "*Crepidula plana*-complex", but it is not monophyletic, since *C. fornicata*, which does not belong to this complex, is part of the ingroup. This study demonstrates that detailed morphological data are useful in phylogenetic studies even at the level of closely related/sibling species, resulting in cladogram with good resolution and a good number of shared, analyzable characters. A biogeographic analysis is also performed considering the distribution of each species under the light of the obtained cladogram, a clear ascension from south to north is the main pattern of the evolutionary history of these species. Further comments on the systematics of *Crepidula aplysioides* Reeve and *C. convexa* Say is also performed.

Key words: Gastropoda, Caenogastropoda, Calyptraeidae, West Atlantic, Phylogeny, Biogeography, new species

Introduction

The *Crepidula plana* complex is defined here as a set of species that occurs in the Western Atlantic. This group of species is difficult to separate by means of shell characters alone and, sometimes, even by anatomical characters. The status of those species, at least the known ones, varies from truly separated species to synonyms of *C. plana* Say, 1822. Collin (2000) was the first to use the term, encompassing Florida species with pale, smooth, flat shell. The concept is extended here for the Western Atlantic that possibly sets closey related species, and to differentiate from the "*C. plana* group" as mentioned by Hoagland (1977) that sets convergent whitish species.

The more we know about those populations, the more the result is the fragmentation in several species. Further studies of those populations indicates/suggests that multiple

4) The methodology of studying detailed morphology is demonstrated to be useful at all levels, from high ranks, to species belonging to same genus, occurring in same geographical area and hardly separated in shell characters.

Bibliography

Cledón, M. & Penchaszadeh, P.E. (2001) Reproduction and brooding of *Crepidula argentina*, Simone, Pastorino and Penchaszadeh, 2000 (Gastropoda: Calyptraeidae). *Nautilus*, 115, 15–21.

Cledón, M., Simone, L.R.L. & Penchaszadeh, P.E. (2004) *Crepidula cachimilla* (Mollusca: Gastropoda) a new species from Patagonia, Argentina. *Malacologia*, 46, 1–18.

Collin, R. (1995) Sex, size, and position: a test of models predicting size at sex change in the protandrous gastropod *Crepidula fornicata*. *The American Naturalist*, 146: 815–831.

Collin, R. (2000) Phylogeny of the *Crepidula plana* (Gastropoda: Calyptraeidae) cryptic species complex in North America. *Canadian Journal of Zoology*, 78, 1500–1514.

Collin, R. (2001) The effects of mode of development on phylogeography and population structure of North Atlantic *Crepidula* (Gastropoda: Calyptraeidae). *Molecular Ecology*, 10: 2249–2262.

Hoagland, K.E. (1977) Systematic review of fossil and recent *Crepidula* and discussion of evolution of the Calyptraeidae. *Malacologia*, 16, 353–420.

Miloslavich, P. & Penchaszadeh, P.E. (2001) Reproduction of *Crepidula aplysioides* Reeve (Caenogastropoda) from La Restinga Lagoon, Venezuela; pg. 224. *Abstracts, World Congress of Malacology 2001*. Salvini-Plawén, L.; Voltzow, J.; Sattmann, H. & Steiner, G. [eds.]. Unitas Malacologica. Vienna, Austria, 417 pp.

Miloslavich, P.; Klein E. & Penchaszadeh, P.E. (2003) Reproduction of *Crepidula navicula* Mørch, 1877 and *Crepidula aplysioides* Reeve, 1859 (Caenogastropoda) from Morrocoy and La Restinga Lagoon, Venezuela. *Nautilus*, 117(4), 121–134.

Nixon, K.C. (2000) Winclada Version 0.9.9. Computer program published by the author. Ithaca, NY.

Oliveira, M.P.; Rezende, G.J.R. & Castro, G.A. (1981) *Catálogo dos moluscos da Universidade Federal de Juiz de Fora*. MEC, UFJF. Juiz de Fora, 520 pp.

Reeve, L.A. (1859) Monograph of the genus *Crepidula*. *Conchologia Iconica*, 11, 5 pls.

Rios, E.C. (1970) *Coastal Brazilian seashells*. Fundação Cidade do Rio Grande. Rio Grande, 255 pp. + 4 maps + 60 pls.

Rios, E.C. (1975) *Brazilian marine mollusks iconography.* Fundação Cidade do Rio Grande. Rio Grande, 331 pp. + 91 pls.

Rios, E.C. (1985) *Seashells of Brazil*. Fundação Cidade do Rio Grande. Rio Grande, 328 pp. + 102 pls.

Rios, E.C. (1994) *Seashells of Brazil*, second edition. Fundação Universidade do Rio Grande. Rio Grande, 368 pp. + 113 pls.

Simone, L.R.L. (2001) Phylogenetic analyses of Cerithioidea (Mollusca, Caenogastropoda) based on comparative morphology. *Arquivos de Zoologia*, 36, 147–263.

Simone, L.R.L. (2002) Comparative morphological study and phylogeny of representatives of the Superfamily Calyptraeoidea (including Hipponicoidea), (Mollusca, Caenogastropoda). *Biota Neotropica*, 2: 1–137.

Simone, L.R.L.; Pastorino, G. & Penchaszadeh, P.E. (2000) *Crepidula argentina* (Gastropoda: Calyptraeidae), a new species from the littoral of Argentina. *Nautilus*, 114, 127–141.

Swofford, D.L. (1991) PAUP (Phylogenetic Analysis Using Parsimony) Version 3.1. Computer program distributed by the Illinois Natural History Survey. Champaign, USA.

